

Evaluation of knowledge and attitudes of radiology department workers about artificial intelligence

Artificial intelligence

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Abstract

Aim: The objective of this study was to investigate the knowledge and attitudes of radiology department workers through a survey.

Material and Methods: In this study, the opinions and attitudes of physicians, residents and technicians working in radiology departments of various hospitals and medical students in our university about AI were collected through a survey conducted between 01/07/2020 and 12/08/2020 and analyzed through a survey.

Results: The response rate of the survey was 25.3%; 47.1% of the participants reported that they have enough knowledge about AI applications in general, while only 25% stated that they had sufficient knowledge about AI applications in radiology. Among all participants, 35.3% thought that AI applications would negatively affect the profession of radiologists, while 30.3% thought that these applications would have positive impacts; 51.9% of the participants think that AI applications will save time for radiologists. The rate of participants who were concerned about the advances in AI was 16.1%.

Discussion: Further similar studies should be conducted on this issue in order to obtain more detailed information and contribute to the literature. We believe that our results will be guiding for further comprehensive studies on the opinions of radiology department workers about the use of AI in the field of radiology.

Keywords

Artificial intelligence; Radiology department; Imaging; Healthcare workers

DOI: 10.4328/ACAM.20453 Received: 2020-12-24 Accepted: 2021-01-25 Published Online: 2021-01-28 Printed: 2021-02-01 Ann Clin Anal Med 2021;12(2):186-190

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Introduction

Artificial intelligence (AI) is defined as computers that behave in the ways that previously thought to require human intelligence and have significant potential to considerably improve radiology, assist patients and reduce costs [1]. AI (decision trees, support vector machines, neural networks, etc.) is currently used in the discussion of a wide range of medical imaging problems, such as imaging segmentation (detection of the limits of a targeted object) [2], registration (visual alignment of anatomic parts on single or multimodality images) [3], and the detection and classification of formations/structures (grouping subgroup medical information) [4]. AI methods are superior in the recognition of complex patterns in imaging data and providing quantitative evaluation rather than qualitative assessment. AI softwares offer high-resolution input images and segmentation mapping.

Radiology workers obtain information from medical images. AI provides further information by extending this specialty to provide better and completely new predictions. It is predicted that the results obtained from images will be interpreted by human radiologists in cooperation with intelligence and autonomous machines. Although machines can make mistakes, they are likely to make more efficient and consistent decisions than humans. In some cases, the machines will contradict human radiologists and will be proven to be accurate. AI imaging interpretation will affect the reporting and communication of the results [5]. AI leads to superintelligence, which is defined as “intelligence that significantly exceeds the cognitive performance of humans almost in every field”. As said by Hawking et al. “Success in creation of AI will be the greatest success in the history of humanity. However, unfortunately, this can be the last until we do not learn how to prevent it” (available at: <https://futurism.com/hawking-creating-ai-could-be-the-biggest-event-in-the-history-of-our-civilization>). It is predicted that AI will be increasingly used in the medical field, affecting decision mechanisms and reducing human errors and cost in near future. This is more prominent in the radiology field, where the potential for using AI is much higher. Analysis of the thoughts of radiology department workers would provide contributions to the development and use of more efficient AI applications.

To our knowledge, although there are numerous studies on the opinions of healthcare workers about the use of AI in various medical areas, we could not find such a study in the field of radiology. Therefore, the objective of this study was to investigate the knowledge and attitudes of radiology department workers through a survey.

Material and Methods

In this study, the opinions and attitudes of physicians, residents and technicians working in radiology departments of various hospitals and medical students in our university about AI were collected through a survey conducted between 01/07/2020 and 12/08/2020 and analyzed.

Ethics committee approval was obtained from Istinye University non-invasive ethics committee for the study. Ethics committee approval number: 75, received on 15/09/2020.

Survey

The survey form used in this study was prepared by the researcher by screening the relevant literature. The survey form was conveyed to potential participants via the Internet and announced via Whatsapp and social media. The survey forms were filled in through face-to-face interviews with the faculty students. It took about 15 minutes to complete each form. The survey forms were conveyed to a total of 807 potential participants. A total of 260 persons replied to the survey, and a total of 56 persons with missing responses or those from other departments were excluded from the study. The forms of the remaining 204 persons were reviewed and analyzed.

The survey consisted of 22 questions. The first 5 questions included socio-demographic data (gender, age group, affiliation, duration of experience and subspecialty), while the remaining 17 questions measured the knowledge and attitudes of the participants about AI. In the survey, questions 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 and 21 were scored with the Likert-5 scale, and pointed as strongly agree: 1, agree: 2, undecided: 3, disagree: 4 and strongly disagree: 5. In addition, the survey involved two open-end questions. These questions inquired whether there were AI applications in the institution where the participant was working and her/his opinion on the areas where AI would be beneficial in the radiology department.

The questions about AI in the survey are given in Table 1.

In the analysis of the obtained data, continuous variables are expressed as mean \pm standard deviation, and the categorical variables are expressed in frequency and percentage.

Results

A total of 204 participants responded to the survey. The response rate of the survey was 25.3%. Forty-five of all participants (22.1%) were radiologists, 56 (27.5%) were residents, 38 (18.6%) were technicians, and 65 (31.9%) were medical faculty students. One hundred twenty-two of the participants (59.8%) were female and 82 (40.2%) were male. When age groups of the participants were examined, 101 (49.5%) were aged 18-29 years, 66 (32.3%) were aged 30-39 years, 27 (13.2%) were aged 40-49 years, 8 (3.9%) were aged 50-59 years and 2 (1%) were \geq 60 years old group. The distribution of the age groups of participants by positions is given in Figure 1.

When affiliations of the participants were examined, 113 (55.3%) were working in a university hospital, 56 (27.5%) in a training and research hospital and 35 (17.2%) in a private hospital. The distribution of participants by affiliations is shown in Figure 2.

Duration of experience in radiology departments was analyzed. Accordingly, the duration of the experience was found as 0-5 years in 135 (66.2%), 5-10 years in 28 (13.7%), 10-20 years in 25 (12.3%) and \geq 20 years in 16 (7.8%) participants. The distribution of participants according to the duration of the experience is shown in Figure 3.

When the answers given to the questions evaluating opinions and attitudes of the participants about AI were examined, 47.1% of the participants reported that they have enough knowledge about AI applications in general, while only 25% stated that they have sufficient knowledge about AI applications in radiology. Among all participants, 35.3% thought that AI applications will negatively affect the profession of radiologists, while 30.3%

thought that these applications will cause positive impacts; 22.5% of all participants believed that in establishing a diagnosis AI will be superior over radiologists in near future. The rate of participants who thought that AI will completely replace radiologists was only 6.3%.

Among the participants, 51.9% think that AI applications will save time for radiologists. The rate of participants who stated that they will assume the legal responsibility of imaging results provided by AI was only 5.3%. Of all participants, 12.2% were reported that they will always use AI when making medical decisions in the near future. Among the participants, 54.9% thought that new physician candidates should choose specialty areas where AI can not dominate. The rate of participants who were concerned about the advances in AI was 16.1%. The distribution of survey answers by professional positions is given in Table 2.

Table 1. Survey questions about AI

LIKERT	
In general, do you think that you have enough knowledge about AI applications?	
In particular, do you think that you have enough knowledge about AI applications in radiology?	
Do you agree with the view that AI offers useful applications in medicine?	
Do you think that AI applications will have a negative impact on the profession of radiologists in the near future?	
Do you think that AI applications will have a positive impact on the profession of radiologists in the near future?	
Do you think AI may be superior to radiologists in diagnosing in the near future?	
Do you think that AI could replace radiologists completely in the near future?	
Do you think patients will adopt the use of AI in radiology departments in the near future?	
Do you think AI applications will save time for radiologists?	
If there is a conflict between the AI and the physician's results, which one would you prefer?	
In the near future, I will assume legal responsibility for the imaging results of AI applications.	
In the near future, I will always use AI applications when making medical decisions.	
Do you think that new physician candidates should choose specialty branches that AI cannot dominate?	
I am concerned about advances in AI.	
OPEN ENDED	
Are AI applications being used in the radiology department in your institution? (If your answer is Yes, please specify the application you are using.)	
Please specify your views on the applications of AI that can be useful in the field of radiology.	

Discussion

One of the mottos of radiology residents is: "The more images you see, the more examinations you report, the better you get". In recent years, imaging has evolved from projection images such as radiographies toward more complex and data-rich tomographic images such as ultrasound (US), CT, tomosynthesis, positron emission tomography and MRI. Radiologists have been reduced to only imaging analysts, while the interpretation of findings was left to other physicians. This is dangerous not only for the radiologist, but also for the patients. Non-radiologists can be completely aware of the clinical situation, but they have no radiologic knowledge. In this case, AI emerges as an opportunity for the improvement of radiology. However, since AI is a relatively new technology, the opinions and attitudes of healthcare workers on this issue show significant variability.

In this study, the opinions and attitudes of radiology department workers and medical faculty students were examined for the first time in the literature. The majority of AI experts think that the developments of this technology will increase the effectiveness of healthcare in the medical field and diagnostic accuracy and will reduce the workload of physicians [6-8]. In recent years, increasing access to health data and the rapid development of big data analysis methods have allowed successful AI applications in every area of medicine [9]. However, the debate is ongoing in the literature about the use of AI in medicine and particularly in the field of radiology. AI is highly resource-dependent, and the development and deployment of AI requires great data and skills. These resources are not evenly distributed, and this may lead to denial of access to potential benefits from AI by some countries, regions and subgroups [10]. In addition, today physicians are legally responsible for poor patient outcomes. It is unclear who will be responsible for poor outcomes of AI in the future [11].

Radiology has always been the specialty that used the most digital information and adopted computer science for the first time [12]. Medical imaging has been the most commonly searched area in AI, and the number of publications on AI have risen to 700-800 from 100-150 in the last decade [12, 13]. More than 50% of the AI studies in radiology are on MRI and CT followed by neuroradiology, musculoskeletal, breast, cardiovascular, urogenital, lung and abdominal issues [12].

Table 2. Opinions of Participants About Artificial Intelligence

OPPINIONS	student (n= 65)		resident (n= 56)		technician (n= 38)		physician (n= 45)	
	agree	disagree	agree	disagree	agree	disagree	agree	disagree
	n (%)		n (%)		n (%)		n (%)	
I have sufficient knowledge of AI	53 (81.5%)	4 (6.1%)	46 (82.1%)	3 (5.3%)	31 (81.5%)	1 (2.6%)	35 (77.7%)	5 (1.1%)
I have sufficient knowledge of AI in radiology	5 (7.6%)	30 (46.1%)	26 (46.4%)	10 (17.9%)	17 (44.8%)	10 (26.3%)	37 (82.2%)	4 (8.9%)
I think that AI will negatively affect profession of radiologists	51 (78.5%)	10 (15.4%)	34 (60.7%)	13 (23.2%)	15 (39.5%)	7 (18.4%)	26 (57.8%)	12 (26.7%)
I think that AI will positively affect profession of radiologists	23 (35.4%)	18 (32.1%)	24 (42.9%)	21 (37.5%)	25 (65.8%)	9 (23.7%)	26 (57.8%)	11 (24.4%)
AI will be superior over radiologists in diagnosis in near future	47 (72.3%)	10 (15.4%)	11 (19.7%)	39 (69.6%)	13 (34.2%)	15 (39.5%)	4 (8.8%)	36 (80.0%)
I think AI will completely replace radiologists in near future	12 (18.5%)	47 (72.3%)	3 (5.4%)	49 (87.5%)	7 (18.4%)	22 (57.9%)	2 (4.4%)	41 (91.1%)
I think patients will adopt the use of AI in radiology department in near future	21 (32.3%)	20 (30.8%)	2 (3.6%)	50 (89.3%)	4 (10.5%)	15 (39.5%)	1 (2.2%)	40 (88.8%)
AI applications will gain time for radiologists	53 (81.5%)	4 (6.2%)	42 (75.0%)	5 (8.9%)	25 (65.8%)	6 (15.8%)	37 (82.2%)	3 (6.6%)
I will assume legal responsibility for the imaging results of AI	11 (16.9%)	38 (58.9%)	3 (5.4%)	49 (87.5%)	4 (10.5%)	27 (71.1%)	1 (2.2%)	43 (95.6%)
I will always use AI applications when making medical decisions	29 (44.6%)	21 (32.3%)	3 (5.4%)	49 (87.5%)	8 (21.1%)	13 (34.2%)	5 (1.1%)	34 (75.6%)
I think physical candidates should choose areas where AI can not dominate	60 (92.3%)	1 (1.5%)	43 (76.8%)	6 (10.7%)	27 (71.1%)	4 (10.6%)	13 (28.9%)	25 (55.6%)

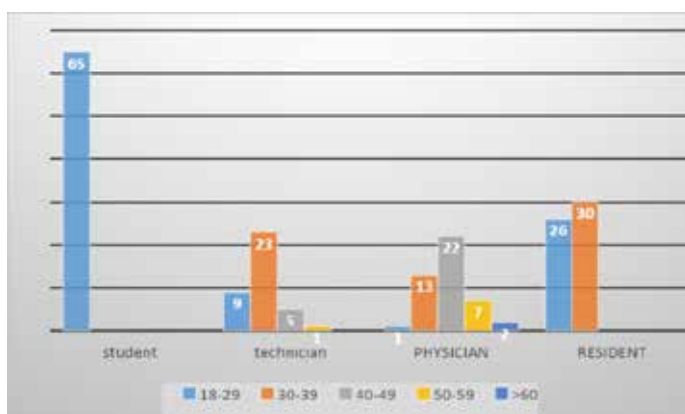


Figure 1. Distribution of age groups among participants

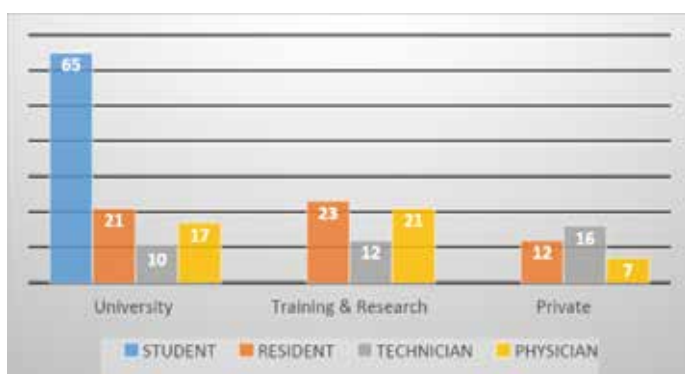


Figure 2. Distribution of participants by affiliations

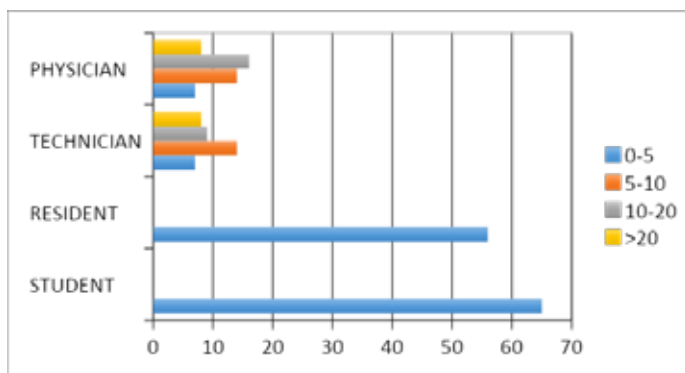


Figure 3. Distribution of participants by duration of experience

In general, AI programs that are being developed include image detection, segmentation, and precise information linking genomic and imaging data [14].

In our study, 80.9% of participants thought that they have sufficient knowledge about AI applications, while this rate was only 41.7% in participants thinking that they have sufficient knowledge about AI applications particularly in the field of radiology. In a survey study by Oh et al. from Korea, opinions of 669 physicians were collected. Only 5.9% of participants reported that they are familiar to AI [15]. Our different results might be due to the different number of participants and including only the workers of the radiology department.

In the present study, 77.9% of the participants reported that AI will completely replace radiologists in near future. This also explains the concerns of participants about AI applications. In fact, 56.9% of the participants stated that

they were concerned about AI. Different results have been reported in the studies in the literature on AI in different issues. For example, in an international survey study by Sarwar et al., attitudes and perspectives of 487 pathologists were evaluated. The participants were asked about whether AI will replace pathologists in near future. Among the participants, 38% reported that AI can not affect employability, while 42.4% stated that AI would create new positions, increasing employment. In the same study, only 17.6% of the participants reported that AI may replace themselves [16]. Again in a survey conducted among psychiatrists in the Duke University and Harvard Medical Faculty, only 4% of the participants stated that AI may replace themselves [9]. In a survey study by Oh et al., 35.4% of Korean physicians thought that AI would replace physicians [15]. In a study by Blease et al. from the UK, the opinions of family physicians were evaluated, and participants reported that cAI is not likely to replace physicians in the near future [15]. In the same study, the majority of the participants (94%) reported that technology can not provide emphatic care as or better than physicians [17].

On the other hand, there are studies in the literature reporting that physicians support AI applications. In a survey study by Hoek et al. opinions of 59 radiologists, 56 surgeons and 55 medical faculty students on AI were investigated [18]. In this study, the majority of participants reported that AI should be included as a support system in radiology. Among students who reported that they do not prefer the radiology department as a specialty, 26% stated AI as a reason. In our study, 70.1% of the participants thought that new physician candidates should choose specialty areas where AI can not dominate. This rate was found as 92.3% among medical faculty students.

Study Limitations

This study has some limitations. First, the number of participants is relatively small. In addition, our results can not be generalized since only radiology department workers were included. Finally, we could not include questions in the survey to directly measure the knowledge of the participants about AI. However, as a strength, our study is the first in the literature to investigate the opinions and attitudes of radiology department workers towards AI.

Conclusion

AI applications show deployment in the field of radiology with commercially existing products. This fact does not mean progression toward a situation where physicians are not needed, but instead, it reinforces clinical decision making. However, healthcare workers in radiology departments have intense concerns that AI will replace them in near future. Increasing the awareness of radiology department workers is important for the contribution of the development of AI applications in the field of radiology. In this study, the opinions and attitudes of radiology workers on AI were investigated and analyzed. We think that further similar studies should be conducted on this issue in order to obtain more detailed information and contribute to the literature. We believe that our results will be guiding for further comprehensive studies on the opinions of radiology department workers about the use of AI in the field of radiology.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

Funding: None

Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

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How to cite this article:

Isil Yurdaisik, Suleyman Hilmi Aksoy. Evaluation of knowledge and attitudes of radiology department workers about artificial intelligence. *Ann Clin Anal Med* 2021;12(2):186-190